IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	Atty. Docket
LUDOVICUS M. TOLHUIZEN ET AL.	PHN 16,896A
Serial No.	Group Art Unit
Filed: CONCURRENTLY	Ex.

Title: TRANSMISSION SYSTEM USING AN IMPROVED SIGNAL ENCODER AND DECODER

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and examination, please amend the above-identified application as follows:

IN THE ABSTRACT

Please delete the Abstract in its entirety and substitute therefor the enclosed Substitute Abstract, where a marked-up version is attached as Appendix A.

IN THE SPECIFICATION

Please amend the specification as follows, where a marked-up version is attached as Appendix B:

Replace the paragraph on page 5, between lines 23-28 of the specification with the following:

The output of the ternary generator 26 is connected to an input of a code converter 29 which is arranged for converting the ternary value at the output of the ternary generator 26 into a sequence of (binary) symbols for transmission. The output of the ternary generator 26 is also connected to a first input of a multiplier 30, optionally via a zero inserter 27. A signal G_F is applied to a second input of the multiplier 30. The output of the multiplier 30 is connected to a first input of an adder 32.

Replace the paragraph spanning pages 5-6, between page 5, line 31, and page 6, line 2 of the specification with the following:

The output of the adaptive codebook 24 is connected to a first input of a multiplier 28 and a signal G_A is applied to a second input of the multiplier 28. The output of the multiplier 28 is connected to a second input signal of the adder 32. The output of the adder 32 which constitutes also the output of the excitation signal generator 22 is applied to a perceptually weighted synthesis filter 38 which received its filter coefficients from the LPC coefficient calculating block 34. An output of the perceptually weighted synthesis filter 38 is connected to a second input of the subtractor 40.

Replace the paragraph on page 6, between lines 12-18 of the specification with the following:

After the optimum parameters I_A and G_A have been found, the controller 42 continues with searching the optimum excitation parameters of the fixed codebook. The excitation parameters of the fixed codebook are the fixed codebook index I_F and the fixed codebook gain G_F. It is also possible that the excitation signal derived form the fixed codebook is constituted by a grid of excitation pulses having a plurality of excitation signal samples separated by a predetermined amount of zeros. In such a case also the position PH of the excitation samples in the grid has to be determined.

Replace the paragraph on page 6, between lines 19-30 of the specification with the following:

The search for the excitation parameters I_F and G_F is performed for each of the possible values of the position PH. The possible sequences of excitation samples are found by using the ternary generator 26 generating said ternary sequence of samples. For each sequence of (ternary) samples the optimum gain is determined. This gain can be determined by trying all possible gain values and selecting the value G_F which results in a minimum error between the perceptually weighted speech signal and the

perceptually weighted synthetic speech signal. It is also possible to determine the gain factor G_F by first determining an auxiliary signal by subtracting from the perceptually weighted speech signal the contribution of the adaptive codebook to the perceptually weighted synthetic speech signal. The square of the gain factor G_F can be found by dividing the cross correlation coefficient of the auxiliary signal and a perceptually weighted synthetic speech signal which is subjected to a gain of 1, by the power of said perceptually weighted synthetic speech signal.

Replace the paragraph on page 8, between lines 4-7 of the specification with the following:

From this count value the codebook converter 29 derives the binary representation to be used for transmission. It is observed that the most right bit of the binary representation according to Table 1 is the least vulnerable, because an error in it causes the ternary value to change only by +1 or -1 at one position.

Replace the paragraph on page 8, between lines 20-23 of the specification with the following:

The codebook converter uses the above mentioned property to determine the sequence of symbols to be transmitted. It only

needs the function $B(i)\prod G(i)$, a function which is also needed in the decoder. Consequently this function can be shared between an encoder and a decoder in a full duplex terminal comprising a transmitter and a receiver.

Replace the paragraph on page 11, between lines 3-10 of the specification with the following:

The fixed codebook index I_F, represented by the sequence of symbols $B(i)$, is applied to an input of a fixed codebook 52 having codebook entries according to the present invention. The output of the codebook 52 is connected to a first input of a multiplier 56. The fixed codebook gain G_F is applied to a second input of the multiplier 56. The output of the multiplier 56 is connected to a second input of the adder 58. At the output of the adder 58 the excitation signal for a synthesis filter 60 is available. The excitation signal is also applied to an input of the adaptive codebook in which the most recent excitation samples are written and from which the least recent excitation samples are removed.

Replace the paragraph on page 13, between lines 17-24 of the specification with the following:

In instruction 70 it is checked whether the quotient QUOD is even or odd. In the case QUOD is even, the value of K is made equal to the remainder REM in instruction 74. In the case QUOD is odd, the value of K is made equal to MSD-1-REM in instruction 72. This different way K is calculated for even and odd values of QUOD is caused by the ordering of the values of G as function of the index i. From Table 1 it can be seen that the value of the most significant digit of G but one increases as function of i for even values of the most significant digit of G. The value of the most significant digit of G but one decreases as function of i for odd values of the most significant digit of G.

IN THE CLAIMS

Please amend claim 3 as follows, where a marked-up version of the amended claim 3 is attached as Appendix C:

3. (Once Amended) Transmission system according to claim 1, characterized in that the number of possible sample values is odd.

REMARKS

The foregoing amendment to claim 3 was made solely to avoid filing the claims in the multiple dependent form so as to avoid the additional filing fee.

The claim was not amended in order to address issues of patentability and Applicant respectfully reserves all rights under the Doctrine of Equivalents. Applicant furthermore reserves the right to reintroduce subject matter deleted herein at a later time during the prosecution of this application or continuing applications. Further, the specification and abstract have been amended to improve from thereof and correct certain informalities.

Respectfully submitted,

By ______________________

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Enclosure: Substitute Abstract
Marked Up Abstract (Appendix A)
Marked Up Amended Specification Paragraphs (Appendix B)
Marked Up Amended Claims (Appendix C)

SUBSTITUTE ABSTRACT

A transmission system includes a transmitter with a signal encoder and a codebook entry selector. The signal encoder has an input for a signal to be encoded. The codebook entry selector selects a codebook entry for obtaining a synthetic signal giving a best approximation of a signal representative of the input signal. The codebook entry includes samples that can assume more than two values and is identified with a sequence of symbols. A receiver has a decoder with a codebook for deriving the codebook, where the codebook entries corresponding to sequences of symbols that differ in one particular symbol value also differ in one signal sample value.

Appendix A

Version with Markings to Show Changes Made to the Abstract

~~In a transmission system a signal to be transmitted is applied to a source encoder (4) for being encoded. The encoded signal is applied to a channel encoder (6) which applies an error correcting code on the encoded input signal. The output signal of the channel encoder (6) is transmitted to a receiver (14) which processes the received signal by means of a channel decoder (18) and a source decoder (20).~~

~~The source encoder comprises a codebook entry selector (42) which selects a ternary number generated by a ternary generator (26), such that a synthetic signal derived from said ternary number is a best approximation of a signal to be encoded. The ternary value found in this way is converted into a binary number in such a way that the ternary values corresponding to binary numbers which differ only in one particular digit, differ only in one single digit. This has the advantage that a transmission error of in said particular digit has a small perceptual effect, because the corresponding ternary number differ only slightly.~~

~~In a preferred embodiment the numerical value of a first codebook entry corresponds to an index of a second codebook entry, and the numerical value of the second codebook entry corresponds to the index of the first codebook entry.~~

A transmission system includes a transmitter with a signal encoder and a codebook entry selector. The signal encoder has an input for a signal to be encoded. The codebook entry selector selects a codebook entry for obtaining a synthetic signal giving a best approximation of a signal representative of the input signal. The codebook entry includes samples that can assume more than two values and is identified with a sequence of symbols. A receiver has a decoder with a codebook for deriving the codebook, where the codebook entries corresponding to sequences of symbols that differ in one particular symbol value also differ in one signal sample value.

Appendix B

Version with Markings
to Show Changes Made to
Paragraphs of the Specification

The following is a marked up version of paragraphs of the specification:

Marked up version of the specification, the paragraph on page 5, between lines 23-28:

The output of the ternary generator 26 is connected to an input of a code converter 29 which is arranged for converting the ternary value at the output of the ternary generator 26 into a sequence of (binary) symbols for transmission. The output of the ternary generator 26 is also connected to a first input of a multiplier 30, optionally via a zero inserter 27. A signal $\cancel{G_C}$ $\underline{G_F}$ is applied to a second input of the multiplier 30. The output of the multiplier 30 is connected to a first input of an adder 32.

Marked up version of the specification, the paragraph spanning pages 5-6 between page 5, line 31, and page 6, line 2:

The output of the adaptive codebook 24 is connected to a first input of a multiplier 28 and a signal G_A is applied to a second input of the multiplier 28. The output of the multiplier 28

is connected to a second input signal of the adder 32. The output of the adder 32 which constitutes also the output of the excitation signal generator ~~28~~ 22 is applied to a perceptually weighted synthesis filter 38 which received its filter coefficients from the LPC coefficient calculating block 34. An output of the perceptually weighted synthesis filter 38 is connected to a second input of the subtractor 40.

Marked up version of the specification, the paragraph on page 6, between lines 12-18:

After the optimum parameters I_A and G_A have been found, the ~~control means~~ controller 42 continues with searching the optimum excitation parameters of the fixed codebook. The excitation parameters of the fixed codebook are the fixed codebook index I_F and the fixed codebook gain G_F. It is also possible that the excitation signal derived form the fixed codebook is constituted by a grid of excitation pulses having a plurality of excitation signal samples separated by a predetermined amount of zeros. In such a case also the position PH of the excitation samples in the grid has to be determined.

Marked up version of the specification, the paragraph on page 6, between lines 19-30:

The search for the excitation parameters I_F and G_F is performed for each of the possible values of the position PH. The possible sequences of excitation samples are found by using ~~a~~ the ternary generator 26 generating said ternary sequence of samples. For each sequence of (ternary) samples the optimum gain is determined. This gain can be determined by trying all possible gain values and selecting the value G_F which results in a minimum error between the perceptually weighted speech signal and the perceptually weighted synthetic speech signal. It is also possible to determine the gain factor G_F by first determining an auxiliary signal by subtracting from the perceptually weighted speech signal the contribution of the adaptive codebook to the perceptually weighted synthetic speech signal. The square of the gain factor G_F can be found by dividing the cross correlation coefficient of the auxiliary signal and a perceptually weighted synthetic speech signal which is subjected to a gain of 1, by the power of said perceptually weighted synthetic speech signal.

Marked up version of the specification, the paragraph on page 8, between lines 4-7:

From this count value the codebook ~~inverter~~ converter 29 derives the binary representation to be used for transmission. It

is observed that the most right bit of the binary representation according to Table 1 is the least vulnerable, because an error in it causes the ternary value to change only by +1 or -1 at one position.

Marked up version of the specification, the paragraph on page 8, between lines 20-23:

The codebook ~~inverter~~ converter uses the above mentioned property to determine the sequence of symbols to be transmitted. It only needs the function $B(i)\prod G(i)$, a function which is also needed in the decoder. Consequently this function can be shared between an encoder and a decoder in a full duplex terminal comprising a transmitter and a receiver.

Marked up version of the specification, the paragraph on page 11, between lines 3-10:

The fixed codebook index I_F, represented by the sequence of symbols B(i), is applied to an input of a fixed codebook 52 having codebook entries according to the present invention. The output of the codebook 52 is connected to a first input of a multiplier 56. The fixed codebook gain ~~G_A~~ G_F is applied to a second input of the multiplier 56. The output of the multiplier 56 is connected to a second input of the adder 58. At the output of the

adder 58 the excitation signal for a synthesis filter 60 is available. The excitation signal is also applied to an input of the adaptive codebook in which the most recent excitation samples are written and from which the least recent excitation samples are removed.

Marked up version of the specification, the paragraph on page 13, between lines 17-24:

In instruction 70 it is checked whether the quotient QUOD is even or odd. In the case QUOD is even, the value of K is made equal to the remainder REM <u>in instruction 74</u>. In the case QUOD is odd, the value of K is made equal to MSD-1-REM <u>in instruction 72</u>. This different way K is calculated for even and odd values of QUOD is caused by the ordering of the values of G as function of the index i. From Table 1 it can be seen that the value of the most significant digit of G but one increases as function of i for even values of the most significant digit of G. The value of the most significant digit of G but one decreases as function of i for odd values of the most significant digit of G.

Appendix C

Version with Markings to Show Changes Made to the Claims

The following is a marked up version of amended claim 3:

3. (Once Amended) Transmission system according to claim 1 ~~or 2~~, characterized in that the number of possible sample values is odd.